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Uniform versus Variable Rainfall in a Two Layered Numerical Flow Model in a Granitic Aquifer

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Groundwater flow in an aquifer in a small watershed consists of granitic formations has been numerically simulated. The total area of the watershed is 60km^2 situated about 30km south of Hyderabad, A.P., India. The depth to water level varies from 11m to 20m. The groundwater is withdrawn using more than 700 bore-wells irrigating almost 70% of the area for two crops in a year. The average annual rainfall in the area is about 570 mm and most of that occur in SW monsoon periods during a few rainy days.

The aquifer has been modeled with two layers, the first layer consist of weathered zone varying from 2 to 20m thickness and the second layer consist of fissured/ fractured granites up to 40 to 50 meters. Each layer was divided into 5272 square meshes of 100 m by 100 m providing freedom of introducing highly variable permeabilities to represent heterogeneity of the parameters. Topography values are taken from DEM. The watershed is a closed watershed with a single outflow at the northern boundary where hydraulic heads are prescribed as boundary condition. Hydraulic conductivities values vary from 8.10^{-7} m.s^{-1} to 5.10^{-6} in weathered zone and in fissured zone values range from 1.10^{-7} to 3.10^{-5} m.s^{-1}. The specific yield is taken to 2.4% in the weathered zone and 2% in the fissured zone. Storage coefficient is taken 8.10^{-5} for first layer and 1.10^{-5} for second layer.

The model has been calibrated under steady and 3 years transient conditions with a fairly good match of hydrographs at about 22 wells. Since the rainfall have been measured from a meteorological station situated in the center of the area, a single value of the rainfall was introduced. However, after one year, measurements of rainfall were made at 16 places fairly distributed in the area under a special scheme. Thus with the availability of a number of rainfall measurements and showing clear variability in rainfall. The area was thus divided into 11 zones based on the rainfall variability and the model was run again to compare the result from the single rainfall case. Obviously introduction the introduction of variable rainfall zones have changed the rainfall recharge and thus a few mismatch have occurred. The study has however, revealed that an accurate recharge estimation may be made zone wise and then the model be calibrated before it is used for prediction and management of the groundwater.

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